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Description

The invention relates to an injection pen suitable for being carried in the clothes of a user-patient, comprising a housing incorporating an injection fluid reservoir or cartridge having a variable content, a pump rod that can be biassed against said reservoir or cartridge for altering the content thereof and a drive mechanism for moving said pump rod.

Such an injection pen is known from US patent 4592745 (Rex et al) and is available on the market by the name of "NovoPen" and is supplied by Novo-Industri in Denmark. The pen was developed for administering insulin to diabetics, when on a so-called basal/prandial insulin regimen. In such a regimen the basal insulin requirement is met by one daily injection of time-released insulin. The postprandial requirement is met by preprandial injections of small quantities of short-term insulin. Thus the patient can vary the quantity of insulin to be administered and, in relation to that, also the quantity and moment of food intake. This freedom is further increased by the fact that the injection pen for the preprandial injections has such a size that it can easily be carried in garment pockets, such as an inside pocket of a jacket, and is therefore always within reach.

With this known injection pen a small dose (2 International Units) can be administered by pressing a push button, causing a pump rod to move and displace, in its turn, a piston in a cartridge filled with insulin. When pressing the push button the user will hear and count two clicks. These clicks are to be remembered by the patient in order to be sure of the delivered dose and the dose that is still to be delivered. After the insulin has been delivered, the push button returns to its initial position, and the pump rod, as well as the piston, remain in place.

The invention aims to provide an injection pen of the type described in the preamble which offers improved ease and reliability in use, i.a. in that it comprises safe-guards against injecting insulin in fatty tissue offering high counter-pressure and in that the patient can obtain visual or auditory information on e.g. the progress of the delivery of insulin.

The injection pen according to the invention is characterized in that said drive mechanism comprises an electromotor which is controlled by an electronic control unit comprising memory means, said memory means having areas assigned as first dose memory means for storing a data corresponding to a certain number of dose units of injection fluid, the pen further incorporating an externally operable dose set unit for setting said data and a display and/or a tone signal generator controlled by said first dose memory means for representation of said certain number to the user-patient, and a measuring unit for measuring the stock in said reservoir or cartridge, said control unit comprising a down counter circuit means that is controlled by the data from said measuring unit and reduces the data stored in said first dose memory means accordingly.

With the electromotor the force exerted on the pump rod can be kept substantially constant at a desired level during driving. Even the exertion of too much (more than normally needed) force by the patient does not result in undesired delivery anymore. The electronical control unit offers possibilities to include a range of functions in the injection pen that are not available in the known injection pen and that have to be performed by the user himself.

By the dose set unit to be operated by the patient data can be stored in the first dose memory means and set to a value that corresponds with the desired dose. The set value is displayed on the display in the form of dose units or, for the convenience of a visually handicapped user, emitted in the form of tone signals from the tone signal generator. The measuring unit and the down counter circuit of the control unit provide the registration of each delivered dose unit, and through the connection with the first dose memory means each delivered dose unit is shown on the display and/or emitted by the tone signal generator. Thus the data stored in the first dose memory means is adapted to the actual sitation, while providing the user with information on the progress of the delivery.

The rotary movements of the electromotor can be converted through a gear and transmission system to a translation movement of the pump rod. This also shifts the piston, thus displacing the insulin fluid.

In US patent 4529401 (Leslie et al) is disclosed a device for supplying a medicinal fluid to a patient. This device is an infusion apparatus which is designed to be carried on the body and to be continuously connected thereto through a delivery tube ending in a needle permanently affixed to the patient. The infusion apparatus comprises an electronical control unit and a RAM for storing data such as basal rate and concentration and a keyboard for setting said data as well as a display controlled by the RAM. The known infusion apparatus also includes an electromotor and a drive mechanism comprising a rod for advancing the plunger of a syringe incorporated in said infusion apparatus for delivering a basis dose at equal intervals. The user can monitor the amount of medicine that remains inside the syringe by markings on the syringe visible through a window in the housing.

According to a preferred embodiment the memory means have areas areas assigned as reservoir stock memory means for storing a data corresponding to the number of units of injection fluid present in said reservoir or cartridge, said reservoir stock memory means being directly fed by a battery in said housing, wherein said control unit comprises an up/down counter circuit means that is controlled by the data from said measuring unit and alters the data stored in said reservoir stock memory means accordingly.

Thus in the same manner as with the first dose memory means the data stored in the reservoir stock memory means is adapted to the actual situation.

Preferably the measuring unit comprises a sensor for determining the position of the pump rod.

Advantageously the control unit comprises comparator means that receive signals from the first dose memory means and the reservoir stock memory means and control the operation of the electromotor and said display and/or tone generator. With the aid of the comparator means the set value of the desired dose of insulin is compared with the available insulin stock. If the set value exceeds the available stock the action of the electromotor is blocked by the comparator means, so that no insulin can be delivered. By the display or the tone signal generator the patient's notice can be drawn to the fact that the insulin stock is not sufficient for the quantity to be delivered, desired by him.

According to a preferred embodiment of the injection pen according to the invention the control unit comprises timing means, which receive a signal corresponding to the stock status and, in response thereto, control the operation of the electromotor. This provision is closely related to the fact that the electromotor maintains the pressure with which the pump rod is biassed against the piston at a certain level. By using the timing means the electromotor can be made to stop after a determined period of time has lapsed in which, contrary to what was intended, no insulin delivery could take place since the counterpressure exceeded the pump pressure. This being stopped of the electromotor is an extra safeguard against injecting insulin in undesired places such as in fatty tissue.

According to another preferred embodiment of the injection pen according to the invention the memory means have areas assigned as second dose memory means for storing a data corresponding to the data stored in said first dose memory means, which second dose memory means are fed direct by a battery in said housing. With the aid of the second dose memory means, which also keep the data stored in them after the injection pen has been switched off, information can be obtained on the size of the previous insulin delivery upon switching the injection pen on again.

By having said memory means, said comparator means, said down counter circuit means, said up-/down counter circuit means and said timing means incorporated in an integrated circuit, which incorporates a processor and is comprised in said control unit, the injection pen can be kept very small in spite of the great number of functions it possesses. Therefore the injection pen is very handy and user-friendly.

According to an advantageous embodiment the electromotor is of reversible construction so that the pump rod can be retracted to thereby refill the cartridge. The piston is moved along in the reservoir and insulin can be drawn in as a consequence of the thus created vacuum. This has the advantage that the injection pen can also be used without prefilled cartridges.

The injection pen according to the invention will hereafter be described on the basis of the drawing, in which :

figure 1 schematically reyresents the structure of the injection pen ;

figure 2 represents a view along the arrows II-II in figure 1, with displaced cap, however ;

figure 3 represents a block diagram of i.a. the electronic control unit of the injection pen.

The housing 26 of the injection pen 1 represented in figure 1 incorporates i.a. a magazine 2 in which an insulin reservoir 3 can be disposed, a pump rod 4 and, as drive mechanism for the pump rod, an electromotor 6, that can be a DC motor. The insulin reservoir 3 can e.g. be a cartridge of the trademark Actrapid HM Penfill commercially available.

The injection pen 1 is shown in figure 1 in its ready-to-use condition. A needle unit 28, comprising a needle and a needle retainer, is screwed onto the head after the cap 27 is displaced from the head to the starter unit 24 of pen 1. When applying the needle unit 28 the needle tip situated within the pen 1 is pushed through a rubber membrane of the reservoir into flowing contact with the insulin contained therein. At the other end of the reservoir 3 there is a piston 29 that can be displaced inside the reservoir for forcing out insulin through the needle into the patient's connective tissue. The displacement of the piston 29 is effected by the translation of the pump rod 4, which movement is caused by the rotary movements of the electro motor 6 converted by a gear/transmission system 8.

Figure 1 also shows a battery 9 for feeding the electromotor 6 and an electronic control unit 7, which will be further elucidated later in this description. Battery 9 can be reached for replacement through a panel 31. A main switch 25 serves to switch the injection pen on or off. Furthermore figure 1 shows a sight-glass 32, possibly disposed on either side of the injection pen 1. This can be used to obtain information on the stock status in reservoir 3. This information is an extra feature beside the electronically controlled information.

The injection pen represented in figure 1 has, in spite of the presence of an electromotor and electronic control unit, such dimensions that it can easily be carried by a patient, e.g. in the inside pocket of his jacket. This makes it easier for a patient to pursue an insulin regimen. The injection pen 1 has e.g. a length of 14 cm, a width of 2 cm and a height of 3 cm.

The flat shape of the pen 1 can be clearly perceived in figure 2. Also visible is a clip with which the pen can e.g. be clipped to the inside pocket of a jacket.

The block diagram in figure 3 shows the schema-

tic structure of the electronic control unit with a few provisions connected thereto, all in accordance with a preferred embodiment of the injection pen 1. In the control unit, comprising at least one integrated circuit incorporating a processor, a memory 11, including a first dose memory 12, a second dose memory 23 and a reservoir stock memory 19, an up/down counter circuit 16 for the first dose memory 12, a down counter circuit 18 also for the first dose memory 12, an up-/down counter circuit 21 for the reservoir stock memory 19 and a timer 22 are all incorporated. Furthermore it comprises some gate circuits 33, 34, 35, 36, 37. A display 13 and/or tone signal generator 14, a sensor 17, a dose set unit 15 and the electromotor 6 are all connected to the electronic control unit 7. Furthermore figure 3 shows the battery 9, the main switch 25, the starter unit 24 and the push button 30.

The mutual relations of the means in the control unit 7 and their relations to provisions disposed outside the control unit will be further elucidated hereafter by means of a full operating cycle.

The injection pen 1 is switched on by operating the main switch 25. The display 13 shows a zero. By pushing the push button 30 the data stored in the second dose memory 23 is also stored, via AND-gate circuit 37, in the first dose memory 12, in its turn, optionally via Exclusive OR-gate circuit 36, represented as number of dose units on display 13. This number of dose units equals the number of dose units delivered during the previous injection. Since the second dose memory 23 is fed direct by battery 9 this data is retained, irrespective of the position of the main switch 25.

If the patient wishes to alter the number of dose units shown on display 13, he can do so by pushing the plus or minus button of the dose set unit 15. Via the up/down counter circuit 16 the data in the first dose memory 12 is then adjusted and so is the number of dose units shown on display 13, in accordance with the patient's wishes. In stead of or beside the display 13 a tone signal generator 14 can be provided, with which a visually handicapped user can obtain similar information by means of tone signals of different pitch (corresponding to a certain number of dose units) and by short tone signals at each change of the set number of dose units.

After the desired number of dose units has been set and the dose set unit 15 has been delivered, the set value is compared, with the aid of the comparator 20, with the insulin stock in the reservoir, stored as a data in the reservoir stock memory 19. When the number of set dose units exceeds the number of insulin units in the reservoir, the comparator 20 renders the operation of the starter unit 24 ineffective, and it causes the display 13 to lighten up and/or the tone signal generator to emit a certain tone signal. For that purpose the comparator 20 can be connected with the first dose memory 12 via Exclusive OR-gate circuit 36 to the display 13 and/or tone signal generator 14. By operating the minus button of the dose set unit 15 the set dose, stored in the first dose memory 12 and shown on display 13 and/or made heard by the tone signal generator 14, is reduced by one unit at the time. The display 13 continues to ligthen up and/or the tone signal generator 14 continues to emit said tone signal until the set number of dose units corresponds with the number of insulin units contained in the reservoir 3. This number is stored as a data in the second dose memory 23. When the set number of dose units is smaller than or equal to the number of insulin units contained in the reservoir then the set number, stored as a data in the first dose memory 12, is also stored as a data in the second dose memory 23.

Subseqently an aseptically packed needle unit can be screwed in the head of the injection pen 1, the one end situated within the pen 1 penetrating into the reservoir 3. Then the patient can place the injection pen 1 on the desired spot on the body and the delivery of the set insulin dose can be started by pushing the cap 27 placed on the starter unit 24. The electromotor 6 is fed by battery 9 as long as the cap is pressed downwards and moves the pump rod 4 forwards so that the piston 29 in the reservoir 3 forces insulin through the needle towards the patient's body.

Starter unit 24, comparator 20, and the first dose memory 12 can be connected to the electromotor 6 through AND-gate circuits 33 and 34.

With the aid of a sensor 17 the progress of the pump rod 4 at the delivery of each insulin unit is observed. In response to the data of the sensor 17 the data stored in the first dose memory 12 is adapted by down counter circuit 18 and the data stored in the reservoir stock memory 19 by an up/down counter circuit 21 at each delivered insulin unit. When the data stored in the first dose memory 12 changes, the number of insulin units that is still to be delivered, shown on display 13 or made audible by tone signal generator 14, changes as well. This way the patient can follow the progress of the delivery.

When the data stored in the first dose memory 12 equals zero units, i.e. when the set dose has been delivered, by means of the presence of the gate circuits 34 the interruption of the supply from the battery to the electromotor is effected. Since the reservoir stock memory 19 and the second dose memory 23 are fed direct by the battery the data stored therein is retained after operating the main switch 25.

When the patient inserts the needle of the injection pen, the situation may very well occur that the needle is inserted not far enough, viz. that it is inserted in fatty tissue. The counterpressure on account of the high mesh rate of the tissue is higher than the pressure in the deep, subcutane connective tissue with a low mesh rate. Under those circumstances, with the injection pen according to the invention undesired

delivery of insulin is prevented, since the forward motion of the piston in the reservoir is not effected by the manual force of the patient but by the force supplied by the electromotor 6. The force that can be exerted on the piston 29 by this electromotor is limited to e.g. about 10N, sufficient to enable delivery into connectve tissue and insufficient for (undesired) delivery in the wrong place, e.g. in fatty tissue. To prevent the electromotor from running on in spite of the fact that insulin delivery cannot take place a timer 22 has been incorporated in the control unit 7. This timer 22 can e.g. receive a signal from the reservoir stock memory 19 which corresponds with the data stored therein and if this data in the reservoir stock memory 19 has not changed over a certain period, e.g. 1 second, which implies that no delivery takes place, it can stop the electromotor 6 through the AND-gate circuit 35. The electromotor is also safe-guarded against running wild.

The electromotor 6 can be constructed reversible, so that the pump rod, and thus the piston, can be moved in the opposite direction. If the patient does not have insulin-filled cartridges at his disposal, with the aid of this provision an empty reservoir 3, disposed in the injection pen 1, can be filled with insulin by inserting the needle in an external quantity of insulin and, subsequently, retracting the piston 29 in the reservoir 3 with the aid of electromotor 6. By means of the presence of sensor 17 and up/down counter circuit 21 the data in the reservoir stock memory 19 is brought into agreement with the filling rate of the reservoir 3. This is also the case when an empty reservoir is not refilled but replaced by a prefilled insulin reservoir, if available.

In order to have the injection pen perform all the above functions and yet remain at an easy-to-handle size, the injection pen 1 according to the preferred embodiment the above means of the control unit 7, the memory 11, the circuits 16, 18, 21, comparator 20 and timer 22 have been incorporated in an integrated circuit. Gate circuits 33, 34, 35, 36 and 37 could also be incorporated in this integrated circuit. Thus an injection pen is obtained that is extremely user-friendly since, apart from its handy design, it can also perform a considerable number of functions that facilitate the use of said injection pen.

Claims

1. Injection pen suitable for being carried in the clothes of a user-patient, comprising a housing incorporating an injection fluid reservoir or cartridge having a variable content, a pump rod that can be biassed against said reservoir or cartridge for altering the content thereof and a drive mechanism for moving said pump rod, characterized in that said drive mechanism (5) comprises an electromotor (6) which is controlled by an electronic control unit (7) comprising memory means (11), said memory means having areas assigned as first dose memory means (12) for storing a data corresponding to a certain number of dose units of injection fluid, the pen further incorporating an externally operable dose set unit (15) for setting said data and a display (13) and/or a tone signal generator (14) controlled by said first dose memory means for representation of said certain number to the user-patient, and a measuring unit (17) for measuring the stock in said reservoir or cartridge, said control unit (7) comprising a down counter circuit means (18) that is controlled by the data from said measuring unit and reduces the data stored in said first dose memory means (12) accordingly.

2. Injection pen according to claim 1, characterized in that said memory means (11) rave areas assigned as reservoir stock memory means (19) for storing a data corresponding to the number of units of injection fluid present in said reservoir or cartridge, said reservoir stock memory means (19) being directly fed by a battery (9) in said housing, and in that said control unit (7) comprises an up/down counter circuit means (21) that is controlled by the data from said measuring unit and alters the data stored in said reservoir stock memory means accordingly.

3. Injection pen according to claim 1 or 2, characterized in that said measuring unit (17) comprises a sensor for determining the position of said pump rod (4).

4. Injection pen according to claim 2 or 3, characterized in that said control unit (7) comprises comparator means (20) that receive signals from said first dose memory means (12) and said reservoir stock memory means (19), said comparator means (20) controlling the operation of said electromotor (6) and said display (13) and/or tone signal generator (14).

5. Injection pen according to one of the preceding claims, characterized in that said control unit (7) comprises timing means (22), which receive a signal corresponding to the stock status in said reservoir or cartridge and in response thereto control the operation of said electromotor (6).

6. Injection pen according to one of the preceding claims, characterized in that said memory means (11) have areas assigned as second dose memory means (23) for storing a data corresponding with the data stored in said first dose memory means (12), said second dose memory means being directly fed by a battery (9) in said housing.

7. Injection pen according to one of the preceding claims, characterized in that said memory means (11; 12, 19 ; 23), said comparator means (20), said down counter circuit means (18), said up/down counter circuit means (21) and said timing means (22) are incorporated in an integrated circuit, which incorporates a processor and is comprised in said control unit (7).

8. Injection pen according to one of the preceding

claims, characterized in that said electromotor (6) is reversible for retracting said pump rod (5) and thereby refilling said cartridge with injection fluid.

Patentansprüche

1. Injektionsspritze des Types eines Feders, die geeignet ist, um in den Kleidern eines Benutzer-Patienten getragen zu werden, mit einem Gehäuse, das einen Injektionsflüssigkeitsbehälter oder -patrone mit variablem Inhalt aufnimmt, einer Pumpenstange, die gegen den Behälter oder die Patrone gespannt werden kann, um deren Inhalt zu ändern, und einem Antriebsmechanismus zum Bewegen der Pumpenstange, **dadurch gekennzeichnet**, dass der Antriebsmechanismus (5) einen Elektromotor (6), enthält, der durch eine elektronische Steuereinheit (7) gesteuert wird, die Speichermittel (11) enthält, wobei die Speichermittel Bereiche haben, die als erste Dosisspeichermittel (12) bestimmt sind, um einer bestimmten Anzahl von Dosiseinheiten der Injektionsflüssigkeit entsprechende Daten zu speichern, und die Spritze ferner eine von aussen bedienbare Dosiseinstelleinheit (15) zum Einstellen der Daten umfasst und eine Anzeige (13) und/oder einen Tonsignalgenerator (14) die durch die ersten Dosisspeichermittel gesteuert sind, um die bestimmte Anzahl dem Benutzer-Patienten darzustellen, und eine Messeinheit (17) zur Messung des Vorrates in dem Behälter oder der Patrone aufnimmt, wobei die Steuereinheit (7) einen Rückwärtszählkreis (18) enthält, der durch die Daten der Messeinheit gesteuert wird und die in den ersten Dosisspeichermitteln (12) gespeicherte Daten entsprechend reduziert.

2. Injektionsspritze nach Anspruch 1, **dadurch gekennzeichnet**, dass die Speichermittel (11) Bereiche haben, die als Behältervorratsspeichermittel (19) zum Speichern Daten die mit der Anzahl von Einheiten der in dem Behälter oder der Patrone vorhandenen Injektionsflüssigkeit übereinstimmen bestimmt sind, wobei die Behältervorratsspeichermittel (19) direkt durch eine Batterie (9) im Gehäuse gespeist werden, und dass die Steuereinheit (7) einen Vorwärts/Rückwärtszählkreis (21) enthält, der durch die Angabe der Messeinheit gesteuert ist und die in den Behältervorratsspeichermitteln gespeicherte Angabe entsprechend ändert.

3. Injektionsspritze nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, dass die Messeinheit (17) einen Sensor zum Bestimmen der Lage der Pumpenstange (4) enthält.

4. Injektionsspritze nach Anspruch 2 oder 3, **dadurch gekennzeichnet**, dass die Steuereinheit (7) Vergleichermittel (20) enthält, die Signale von den ersten Dosisspeichermitteln (12) und den Behältervorratsspeichermitteln (19) erhält, wobei die Vergleichermittel (20) den Betrieb des Elektromotors (6) und der Anzeige (13) und/oder des Tonsignalgenerators (14) steuern.

5. Injektionsspritze nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, dass die Steuereinheit (7) Zeitsteuermittel (22) enthält, die ein dem Vorratsstand in dem Behälter oder der Patrone entsprechendes Signal erhält und als Reaktion darauf den Betrieb des Elektromotors (6) steuern.

6. Injektionsspritze nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, dass die Speichermittel (11) Bereiche aufweisen, die als zweite Dosisspeichermittel (23) zum Speichern einer der in den ersten Dosisspeichermitteln (12) gespeicherten Daten entsprechenden Daten bestimmt sind, wobei die zweiten Dosisspeichermittel direkt durch eine Batterie (9) im Gehäuse gespeist sind.

7. Injektionsspritze nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, dass die Speichermittel (11 ; 12, 19 ; 23), die Vergleichermittel (20), der Rückwärtszählkreis (18), der Vorwärts/Rückwärtszählkreis (21) und die Zeitsteuermittel (22) in einem integrierten Schaltkreis integriert sind, der einen Prozessor aufweist und in der Steuereinheit (7) enthalten ist.

8. Injektionsspritze nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, dass der Elektromotor (6) umkehrbar ist, um die Pumpenstange (5) zurückzuziehen und dadurch die Patrone mit Injektionsflüssigkeit wieder zu füllen.

Revendications

1. Dispositif d'injection de type stylo propre à être accroché aux vêtements d'un patient utilisateur, comportant une boîte comprenant un réservoir ou une cartouche de fluide d'injection de contenu variable, une tige de pompe qui peut être sollicitée contre le réservoir ou la cartouche pour agir sur le contenu et un mécanisme d'entraînement pour déplacer la tige de pompe, caractérisé en ce que le mécanisme d'entraînement (5) comprend un moteur électrique (6) qui est commandé par une unité de commande électronique (7) comprenant une mémoire (11), cette mémoire comportant des zones attribuées en tant que première mémoire de dose (12) pour le stockage d'une donnée correspondant à un nombre déterminé d'unités de dose de fluide d'injection, le dispositif d'injection comprenant, en outre, une unité de réglage de dose pouvant être actionnée de l'extérieur (15) pour le réglage de la donnée et une unité d'affichage (13) et/ou un générateur de signaux sonores (14) commandé par la première mémoire de dose pour la présentation dudit nombre déterminé à l'attention du patient utilisateur, et une unité de mesure (17) pour mesurer le contenu restant dans le réservoir ou la cartouche, l'unité de commande (7) comprenant un circuit décompteur (18) qui est commandé par les

données en provenance de l'unité de mesure et qui réduit de manière correspondante les données stockées dans la première mémoire de dose (12).

2. Dispositif d'injection de type stylo suivant la revendication 1, caractérisé en ce que la mémoire (11) présente des zones attribuées en tant que mémoire de contenu de réservoir (19) pour stocker une donnée correspondant au nombre d'unités de fluide d'injection présent dans le réservoir ou la cartouche, la mémoire de contenu de réservoir (19) étant directement alimentée par une batterie (9) prévue dans la boîte, et en ce que l'unité de commande (7) comprend un circuit de compteur/décompteur (21) qui est commandé par les données en provenance de l'unité de mesure et modifie de manière correspondante les données stockées dans la mémoire de contenu de réservoir.

3. Dispositif d'injection de type stylo suivant la revendication 1 ou 2, caractérisé en ce que l'unité de mesure (17) comprend un détecteur pour déterminer la position de la tige de pompe (4).

4. Dispositif d'injection de type stylo suivant la revendication 2 ou 3, caractérisé en ce que l'unité de commande (7) comprend un comparateur (20) qui reçoit des signaux de la première mémoire de dose (12) et de la mémoire de contenu de réservoir (19), ce comparateur (20) commandant le fonctionnement du moteur électrique (6) et de l'unité d'affichage (13) et/ou du générateur de signaux sonores (14).

5. Dispositif d'injection de type stylo suivant l'une quelconque des revendications précédentes, caractérisé en ce que l'unité de commande (7) comprend un moyen temporisateur (22) qui reçoit un signal correspondant au contenu restant dans le réservoir ou la cartouche et qui, en réponse à ce signal, commande le fonctionnement du moteur électrique (6).

6. Dispositif d'injection de type stylo suivant l'une quelconque des revendications précédentes, caractérisé en ce que la mémoire (11) comporte des zones attribuées en tant que seconde mémoire de dose (23) pour stocker une donnée correspondant à la donnée stockée dans la première mémoire de dose (12), la seconde mémoire de dose étant directement alimentée par une batterie (9) placée dans la boîte.

7. Dispositif d'injection de type stylo suivant l'une quelconque des revendications précédentes, caractérisé en ce que la mémoire (11 ; 12, 19 ; 23) ; le comparateur (20), le circuit décompteur (18), le circuit de compteur/décompteur (21) et le moyen temporisateur (22) sont inclus dans un circuit intégré qui comprend un processeur et est incorporé dans l'unité de commande (7).

8. Dispositif d'injection de type stylo suivant l'une quelconque des revendications précédentes, caractérisé en ce que le moteur électrique (6) est réversible pour rétracter la tige de pompe (5) et recharger la cartouche de fluide d'injection.

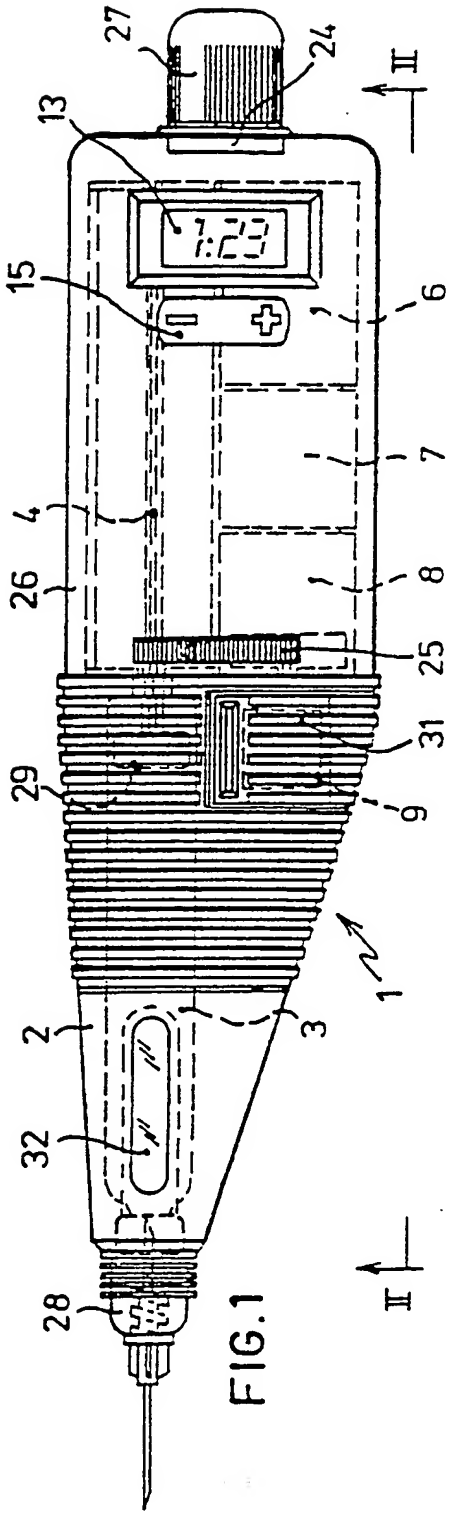

FIG.1

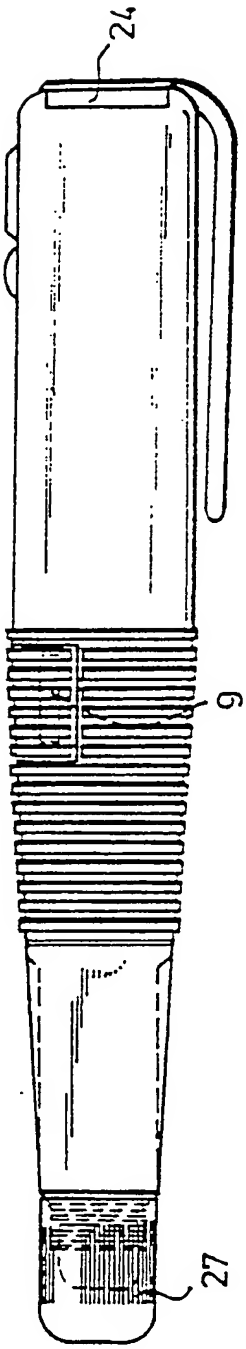

FIG.2

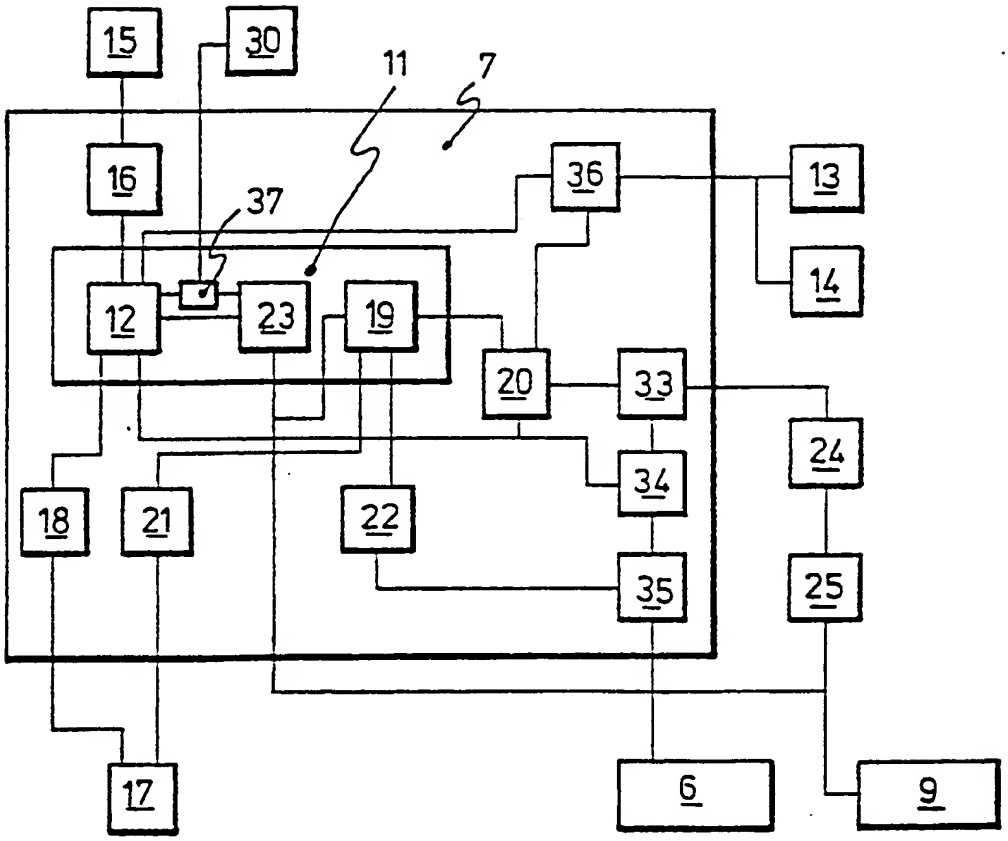

FIG.3